

Claims:

1. A minimal invasive device for minimal traumatic surgery partly introduced into body cavity, assembled through at least two – the first and the second surgical openings in a body cavity wall, passing through said first surgical opening during device operation, and having:

- An inner unit, an outer unit, and an intermediate part, which is an integral part of one of said units, has a free end, is designed to passing through body cavity wall via said first surgical opening, and having a maximal transverse dimension substantially lesser than a maximal transverse dimension of said inner unit; said intermediate part in assembled operating device is disposed between said units and inside said first surgical opening,
- Said inner unit designed to inserting into body cavity and withdrawing therefrom through said second surgical opening and having maximal transverse dimension, which is substantially more than maximal transverse dimension of said first surgical opening minimally needed for inserting therethrough said intermediate part thereby eliminating the insertion of said inner unit into body cavity and withdrawing therefrom through said first surgical opening,
- A coupling means partly disposed on said intermediate part and adapted to operative connecting and disconnecting said inner unit and said outer unit while said inner unit is disposed inside body cavity.

2. Device of claim 1, wherein said maximal transverse dimension of intermediate part does not exceed 13 mm.

3. Device of claim 2, wherein said maximal transverse dimension of intermediate part does not exceed 10 mm.

4. Device of claim 1, wherein said outer unit and said intermediate part are made as an integral outer part and said coupling means are disposed on said intermediate part and on said inner unit and adapted to the connection and disconnection of said outer part and said inner unit in body cavity after inserting said inner unit into body cavity through said

second surgical opening and said free end of intermediate part into body cavity through said first surgical opening.

5. Device of claim 1, wherein said inner unit and said intermediate part are made as an integral inner part and said coupling means are disposed on said intermediate part and on said outer unit and adapted to the connection and disconnection of said outer unit and said inner part beyond body cavity after inserting said inner part into body cavity through said second opening and leading said free end of intermediate part through body cavity wall via said first surgical opening from the inside to the outside of body cavity.

6. Device of claim 1, wherein said free end of intermediate part is provided with a penetrating tip designed for piercing body cavity wall to form said first surgical opening and simultaneously to insert said intermediate part into formed said first surgical opening.

7. Device of claim 1, wherein said inner unit has an inner unit body, said outer unit has an outer unit body, there is a transmitting means passing in said intermediate part and designed to the transmission of functional action between said outer and inner units, and said coupling means have a units bodies connector for the connection of said inner unit body to said outer unit body.

8. Device of claim 7, wherein said outer unit has an actuating means, said transmitting means presents a drive means, and said functional action is a control movement of said actuating means transmitted by said drive means to said inner unit.

9. Device of claim 3, wherein said maximal transverse dimension of said intermediate part does not exceed 6 mm.

10. Device of claim 7, wherein said transmission of functional action presents the transmission of electric power.

11. Device of claim 10, presenting an electrosurgical instrument.

12. Device of claim 7, wherein said transmission of functional action presents the transmission of electromagnetic waves.
13. Device of claim 10, presenting a camera.
14. Device of claim 12, which presents a surgical laser.
15. Device of claim 12, which presents a medical endoscope
16. Device of claim 8, wherein in assembled device, said inner unit body is immovable relative to said outer unit body in the direction along a longitudinal axis of said assembled device.
17. Device of claim 16, wherein said coupling means includes a drive means connector.
18. Device of claim 16, wherein said inner unit body in said assembled device is rotatable around said longitudinal axis and relative to said outer unit body.
19. Device of claims 16, presenting a surgical stapler for applying a plurality of staples to patient's tissues, wherein said inner unit has a staples' cartridge and an anvil adapted to juxtaposition with said staples' cartridge and bending said staples to suture patient's tissues.
20. Device of claim 4, 17, 19, presenting a circular stapler for bowel circular anastomosis, wherein said anvil is disposed distally of said staples' cartridge, there is an anvil unit including said anvil and an anvil shaft, there is a cartridge unit including said inner unit body, said cartridge, and a connector lock means eliminating the disconnection of said drive means connector at least during tissue stapling, said cartridge unit is secured to a body of said intermediate part by said units bodies connector, said drive means include at least one control rod connecting said actuating means and said anvil shaft, and said drive means connector includes an anvil shaft engagement member disposed on a proximal free end of said anvil shaft and a control rod engagement member disposed on a distal free end of said control rod.

21. Device of claim 19, presenting a linear stapler.
22. Device of claim 1, wherein said inner unit is adapted to inserting into body cavity through a hand port mounted in said second surgical opening.
23. Device of claim 1, wherein said inner unit is adapted to inserting into body cavity through a trocar port mounted in said second surgical opening.
24. Device of claim 4, presenting a trocar device, wherein said outer part presents a trocar portal unit including a trocar port with a sealing means, said outer unit, said intermediate part, and a penetrating means having a protective means, and said inner unit presents an interior fixation member connected to said trocar port inside body cavity to fix said trocar port in body cavity wall after forming said first surgical opening by means of said penetrating means and leading said trocar port distal end through said first surgical opening from the outside to the inside of body cavity.
25. Device of claim 5, presenting a trocar device, wherein said inner part presents a trocar portal unit including a trocar port with a sealing means, said inner unit, said intermediate part, and a penetrating means having a protective means, and said outer unit presents an exterior fixation member connected to said trocar port on the outside of body cavity to fix said trocar port in body cavity wall after forming said first surgical opening by means of said penetrating means and leading said trocar port distal end through said first surgical opening from the inside to the outside of body cavity.
26. A set of surgical instruments for minimal traumatic surgery executed through at least two – the first and the second surgical openings in a body cavity walls, including at least two – the first and the second ports mounted in said first and second surgical openings, respectively, as well as a minimally invasive device assembled through at least two – said first and said second ports, passing through said first port during device operation, and having:
- An inner unit, an outer unit, and an intermediate part, which is an integral part of one of said units, has a free end, is designed to passing its said free end through

body cavity wall via said first port, and having a maximal transverse dimension substantially lesser than a maximal transverse dimension of said inner unit; said intermediate part in assembled operating devise is disposed between said units and inside said first port,

- Said inner unit designed to inserting into body cavity and withdrawing therefrom through said second port and having maximal transverse dimension, which is substantially more than maximal transverse inner dimension of said first port minimally needed for inserting therethrough said intermediate part thereby eliminating the insertion of said inner unit into body cavity and withdrawing therefrom through said first port,
- A coupling means disposed on said intermediate part and on one of said units and adapted to operative connecting and disconnecting said inner unit and said outer unit while said inner unit is disposed inside body cavity.

27. Set of claim 26, wherein said outer unit and said intermediate part are made as an integral outer part and said coupling means are disposed on said intermediate part and on said inner unit and adapted to the connection and disconnection of said outer part and said inner unit in body cavity after inserting said inner unit into body cavity through said second port and said free end of intermediate part into body cavity through said first port.

28. Set of claim 26, wherein said inner unit and said intermediate part are made as an integral inner part and said coupling means are disposed on said intermediate part and on said outer unit and adapted to the connection and disconnection of said outer unit and said inner part beyond body cavity after inserting said inner part into body cavity through said second port and leading said free end of intermediate part through said first port from the inside to the outside of body cavity.

29. Set of claim 26, wherein said inner unit has an inner unit body, said outer unit has an outer unit body, there is a transmitting means passing in said intermediate part and designed to the transmission of functional action between said outer and inner units, and said coupling means have a units bodies connector for the connection of said inner unit body to said outer unit body.

30. Set of claim 26, wherein said second port presents a hand port.
31. Set of claim 26, wherein an internal diameter of said first port does not exceed 13 mm.
32. Set of claim 26, including at least one trocar device for the execution of at least one said first surgical opening and mounting at least one first port therein.
33. Set of claims 28, 32, wherein said trocar device has said inner part presenting a trocar portal unit including a trocar port with a penetrating means and said outer unit presenting an exterior fixating member connected to said trocar port outside body cavity to fixate said trocar port in body cavity wall after leading its distal end through said first surgical opening from the inside to the outside of body cavity.
34. Set of claim 33, wherein there are a sealing means including a sealing member and a trocar valve disposed on said trocar port mounted in body cavity wall.
35. Set of claim 33, wherein said penetrating means presents an obturatorless unit detachably connected to a distal end of said trocar port and having a penetrating sharp tip provided with a protective means for its preventing from any contact with staff.
36. Set of claims 30, 32, including one said hand port and at least one said trocar device used for execution of a few said first surgical openings and mounting said first ports of equal dimensions therein.
37. Set of claims 30, 32, including one said hand port, at least one said trocar device, and a plurality of said inner units of various functional designations and transverse dimensions adapted to connecting and using with at least one said outer unit.
38. Method of preparation and execution of minimally traumatic surgical operations implemented with at least one minimally invasive device comprising an inner unit, an outer unit, and an intermediate part, which is an integral part of one of said units, has a free end, is designed to passing its said free end through body cavity wall, and having a

maximal transverse dimension substantially lesser than a maximal transverse dimension of said inner unit, and coupling members disposed on said intermediate part and on one of said units and adapted to operative connecting and disconnecting said inner and outer units,

said method comprising:

- Forming at least two – the first and the second surgical openings in body cavity walls: said second surgical opening is designed for inserting said inner unit therethrough into body cavity and said first surgical opening is designed for leading said free end of intermediate part through body cavity wall and having minimally needed maximal transverse dimension substantially lesser than one of said second surgical opening and said inner unit,
- Inserting said inner unit into body cavity through said second surgical opening,
- Leading said free end of intermediate part through body cavity wall via said first surgical opening,
- Connecting said inner unit to said outer unit by said coupling members with forming an operational assembly so that an assembly inner part is disposed inside body cavity, an assembly outer part is disposed outside body cavity, and said intermediate part is passing through said first surgical opening,
- Execution of surgical operations at least by means of said operational assembly,
- Disconnecting said inner unit from said outer unit after executing needed surgical operations, withdrawing said intermediate part from said first surgical opening, and withdrawing said inner unit from body cavity through said second surgical opening, thus, the components of said minimally invasive device are removed from body cavity through the same openings through which they were inserted.

39. Method of claim 38, wherein a hand port is mounted in said second surgical opening and said inserting said inner unit into body cavity and its holding during said its connecting with outer unit are executed by surgeon's hand inserted into body cavity through said hand port.

40. Method of claim 38, wherein said second surgical opening is executed by a trocar device with mounting a trocar port having internal dimensions allowing said inserting said inner unit into body cavity, therewith said inserting said inner unit into body cavity and its

holding during said its connecting with outer unit are executed by an inner unit holder inserted into body cavity through said trocar port.

41. Method of claim 38, wherein at least one said first surgical opening is executed by a trocar device with mounting a trocar port in at least one said first surgical opening.

42. Method of claim 41, wherein, first, at least part of said trocar device is inserted into body cavity through said second surgical opening and, then, it is used for piercing the body cavity wall from the inside of body cavity for said execution of said first surgical opening and mounting therein said trocar port.

43. Method of claim 42, implemented with said trocar device having said inner part in the form of a trocar portal unit including a trocar port with sealing means, said inner unit, said intermediate part, and a detachable obturatorless penetrating unit with a sharp penetrating end and a protective means, and said outer unit presenting an exterior fixating member; (method) wherein, first, said trocar device inner part is inserted into body cavity through said second surgical opening, further, surgeon, acting via said second surgical opening, pierces body cavity wall by said trocar device inner part from the inside of body cavity up to the abutment of said inner unit against body cavity wall to form said first surgical opening and mount said trocar port therein, then surgeon removes said detachable penetrating unit from an exterior end of said trocar port and mounts said exterior fixating member thereon to secure said trocar port in body cavity wall.

44. Method of claim 38, implemented with said minimally invasive device having said intermediate part, whose said free end is provided with a sharp penetrating tip; (method) wherein said forming said first surgical opening and said inserting said intermediate part into first surgical opening is executed simultaneously as a result of through piercing the body cavity wall by said intermediate part with sharp penetrating tip, thereafter, surgeon executes said connecting said inner and outer units and said forming said operational assembly.

45. Method of claims 38, wherein one said second surgical opening and a few said first surgical openings are executed and used.

46. Method of claims 38, wherein one said second surgical opening, at least one said first surgical opening, and a plurality of said inner units of various designations and transverse dimensions are used, therewith said various inner units are inserted into body cavity through said second surgical opening for connecting to at least the same said outer unit.

47. Method of preparation and execution of thoracic minimally traumatic surgery implemented with at least one minimally invasive device comprising an inner unit, an outer unit, an intermediate part, which is an integral part of one of said units, has a free end, is designed to leading its said free end through body cavity wall, and having a maximal transverse dimension substantially lesser than a maximal transverse dimension of said inner unit; and coupling members disposed on said intermediate part and on one of said units and adapted to operative connecting and disconnecting said inner and outer units,
said method comprising:

- Forming at least two – the first and the second surgical openings in patient's thoracic cavity: said second surgical opening begins below a costal arch and passes into thoracic cavity to provide the access of surgeon's hand into thoracic cavity and designed for inserting therethrough said inner unit into thoracic cavity; said at least one first surgical opening located in intercostal gap, designed for inserting said free end of intermediate part through thoracic cavity wall, and having minimally needed maximal transverse dimension substantially lesser than one of said second surgical opening and said inner unit,
- Inserting said inner unit into thoracic cavity through said second surgical opening,
- leading said free end of intermediate part through body cavity wall via said first surgical opening,
- Connecting said inner unit to said outer unit by said coupling members with forming an operational assembly so that an assembly inner part is disposed inside thoracic cavity, an assembly outer part is disposed outside thoracic cavity, and said intermediate part is passing through said first surgical opening,
- Execution of surgical operations at least by said operational assembly,

- Disconnecting said inner unit from said outer unit after executing needed surgical operations, withdrawing said intermediate part from said first surgical opening, and withdrawing said inner unit from thoracal cavity through said second surgical opening by surgeon's hand.

48. Method of claim 47, wherein said second surgical opening is passed through abdominal cavity and further through patient's diaphragm.

49. Method of claims 47, wherein a hand port is mounted into said second surgical opening and said inserting said inner unit into thoracal cavity and its holding during said its connecting with outer unit are executed by surgeon's hand inserted into thoracal cavity through said hand port.

50. Method of claim 47, wherein at least one said first surgical opening is executed by a trocar device with mounting a trocar port in at least one said first surgical opening.

51. Method of claim 47, wherein surgeon helps to execute the surgical operations by his hand inserted into thoracal cavity through said second surgical opening.

52. Method of preparation and execution of thoracic minimally traumatic surgery implemented with at least one minimally invasive device having a functional head and an actuating means,
said method comprising:

- Forming at least two – the first and the second surgical openings in patient's thoracal cavity: said second surgical opening begins below a costal arch, passes into thoracal cavity and designed for inserting surgeon's hand into thoracal cavity, and at least one said first surgical opening located in intercostal gap, designed for the operation of said minimally invasive device in thoracal cavity, and having minimally needed maximal transverse dimension substantially lesser than one of said second surgical opening,
- Inserting surgeon's hand into thoracal cavity through said second surgical opening,

- Inserting said minimally invasive device into thoracal cavity at least partly through said first surgical opening so that its said functional head is disposed in thoracal cavity and its said actuating means is disposed outside thoracal cavity,
- Execution of surgical operations by said at least one minimally invasive device and surgeon hand inserted into thoracal cavity through said second opening.

53. Method of claims 52, wherein a hand port is mounted into said second surgical opening.